



Climate change impacts on natural toxins in food production systems, exemplified by deoxynivalenol in wheat and diarrhetic shellfish toxins

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Abstract:

Climate change is expected to affect food and feed safety, including the occurrence of natural toxins in primary crop and seafood production; however, to date, quantitative estimates are scarce. This study aimed to estimate the impact of climate change effects on mycotoxin contamination of cereal grains cultivated in the terrestrial area of north west Europe, and on the frequency of harmful algal blooms and contamination of shellfish with marine biotoxins in the North Sea coastal zone. The study focused on contamination of wheat with deoxynivalenol, and on abundance of *Dinophysis* spp. and the possible relationship with diarrhetic shellfish toxins. The study used currently available data and models. Global and regional climate models were combined with models of crop phenology, mycotoxin prediction models, hydrodynamic models and ecological models, with the output of one model being used as input for the other. In addition, statistical data analyses using existing national datasets from the study area were performed to obtain information on the relationships between *Dinophysis* spp. cell counts and contamination of shellfish with diarrhetic shellfish toxins as well as on frequency of cereal cropping. In this paper, a summary of the study is presented, and overall conclusions and recommendations are given. Climate change projections for the years 2031-2050 were used as the starting point of the analyses relative to a preceding 20-year baseline period from which the climate change signal was calculated. Results showed that, in general, climate change effects lead to advanced flowering and harvest of wheat, and increased risk of contamination of wheat with deoxynivalenol. Blooms of dinoflagellates were estimated to occur more often. If the group of *Dinophysis* spp. behaves similarly to other flagellates in the future then frequency of harmful algal blooms of *Dinophysis* spp. may also increase, but consequences for contamination of shellfish with diarrhetic shellfish toxins are uncertain. Climate change will also have indirect effects on toxin contamination, which may be equally important. For example, the frequency of cropping of wheat and maize in north Europe was projected to increase under climate change, which will also increase the risk of contamination of the grains with deoxynivalenol. Risk managers are encouraged to consider the entire range of the predictions of climate change effects on food safety hazards, rather than median or average values only. Furthermore, it is recommended to closely monitor levels of mycotoxins and marine biotoxins in the future, in particular related to risky situations associated with favourable climatic conditions for toxin producing organisms. In particular, it is important to pay attention to the continuity of collecting the right data, and the availability and accessibility of databases. On a European level, it is important to stress the need for harmonisation of terminology and data collection.

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Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Special Report on Emissions Scenarios (SRES), Other Climate Scenario

Special Report on Emissions Scenarios (SRES) Scenario: SRES A1

Other Climate Scenario: A1B

Exposure :

weather or climate related pathway by which climate change affects health

Food/Water Quality, Food/Water Quality

Food/Water Quality: Biotoxin/Algal Bloom, Biotoxin/Algal Bloom

Geographic Feature:

resource focuses on specific type of geography

Ocean/Coastal

Geographic Location:

resource focuses on specific location

Non-United States

Non-United States: Europe

European Region/Country: European Region

Other European Region: Northwest Europe

Health Impact:

specification of health effect or disease related to climate change exposure

Infectious Disease, Other Health Impact

Infectious Disease: Foodborne/Waterborne Disease

Foodborne/Waterborne Disease: Marine Toxin Syndrome

Other Health Impact: mycotoxins

Medical Community Engagement:

resource focus on how the medical community discusses or acts to address health impacts of climate change

A focus of content

Model/Methodology:

type of model used or methodology development is a focus of resource

Climate Change and Human Health Literature Portal

Exposure Change Prediction

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Long-Term (>50 years)

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content